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AS 1698 (1988) (English): Protective helmets for
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*"We will sell to no man, and we will not deny
or defer to any man, either justice or right."*

Parliamentary Counsel
Australian Capital Territory

*"The content of the law
should be accessible to the public."*
Honourable Murray Gleeson, AC, QC
11th Chief Justice of the High Court



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AS 1698—1988

Australian Standard®

**PROTECTIVE HELMETS FOR
VEHICLE USERS**

This Australian Standard was prepared by Committee CS/76, Protective Helmets for Motor Cyclists. It was approved on behalf of the Council of the Standards Association of Australia on 10 March 1988 and published on 9 May 1988.

The following interests are represented on Committee CS/76:

Attorney-General's Department
Australia Post
Australian Consumers' Association
Australian Helmet Manufacturers and Importers Association
Australian Motorcycle Council
Australian Road Research Board
Autocycle Council of Australia
British Standards Institution
Commissioner for Consumer Affairs, N.T.
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Confederation of Australian Motor Sport
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AS 1698—1988

Australian Standard®

**PROTECTIVE HELMETS FOR
VEHICLE USERS**

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PREFACE

This Standard was prepared by the Association's Committee on Protective Helmets for Motor Cyclists, to supersede AS 1698—1980.

The committee has made a number of significant changes in this edition, as listed below, but has been unable to complete the preparation of requirements that would have accommodated all matters of concern that were before the committee. A shortage of data and research contributed to this difficulty.

The principal changes in order of appearance include the following:

- (a) Reference to AS 2512, *Methods of testing protective helmets*, for definitions, and test methods.
- (b) Re-expression and amplification of the requirements for the edge of shell neck and eye openings (see Clause 4.3.3).
- (c) Re-expression of the requirements for visors (see Clause 4.4).
- (d) Re-expression of the requirements for the selection of test sites, with a note referring to the intent and variations to be considered (see Clause 6.1).
- (e) Addition of solvent preconditioning for the impact energy attenuation testing where residual and ageing stresses are under consideration (see Clause 6.1). The preconditioning requirements are given in AS 2512.2.
- (f) A note to state that free-end restraints for the retention system are not to be considered as load-bearing (see Clause 6.4).
- (g) A note to provide for the waiving of type tests of the smaller helmets of a series with otherwise equivalent features (see Clause 7).
- (h) An addition to the labelling requirements to show that the liner is essential to the intended performance of the helmet (see Clause 9(g)).

While no longer prepared to prohibit an all black helmet, the committee generally was of the view that a conspicuous (i.e. not dark coloured) helmet is a wise choice. A major influence on the committee decision was the knowledge that black is a colour favoured by many riders, and it is a practice for riders to paint their own helmets black. The painting of a helmet without the full knowledge and controls applied by the manufacturer could seriously degrade the helmet's protective capabilities.

The committee has resolved to specify a performance test to limit the potential to impart rotational accelerations to the head through oblique impacts and frictional forces on external features. Such a test is now specified in BS 6658, *Specifications for protective helmets for vehicle users*, but the committee has not at the time of publication been able to fully assess that test.

Other requirements to be reviewed, and amended as soon as resolved, include the following:

- (i) *Shell neck and eye openings*. While Clause 4.3.3 does require either specified attached edging or full rounding of the shell edge, the committee recognizes that the object is to avoid cutting edges that may be forced into contact with the face or neck.
- (ii) *Impact sites for energy attenuation tests*. The committee recognizes that test apparatus now in use may require modification to enable impact tests to be applied to sites below the test line. This Standard provides for tests between the test line and the basic plane (see Clause 4.3.1(b)); when headforms that include the jaw are specified, tests in that region are intended. The committee therefore expects suitable test apparatus to be available in due course.
- (iii) *Headforms*. In addition to headforms for impact testing of regions outside the test area, the committee is concerned that no headforms are available to suit helmets for children. This has prevented the Standard from being extended to cater for such sizes. Development of such headforms is also of relevance to Standards for helmets used by children in other activities.
- (iv) *Helmet compression test*. There is evidence to show that such a test is desirable.

Data and research is essential to the continued development of this Standard, and the committee has prepared recommendations for the authorities on projects that are required.

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FOREWORD

The primary purpose of this Standard is to provide a specification for protective helmets for on-road motor cyclists, although other users may gain appropriate protection in other situations. The Standard also provides a basis for helmets used in motor sports where speed is a determining factor. Helmets designed specially for motor sport are available, and these may include features, including extra strength, which are not mandatory in this Standard but which are desirable for certain activities. It is not expected that these features will generally conflict with the requirements of this Standard. Extra features are likely to increase the mass or bulk of the helmet, and the committee considers that this Standard should not impose these disadvantages at this time.

Other Standards (viz AS 2063, *Lightweight protective helmets (for use in pedal cycling, horse riding and other activities requiring similar protection)*, Part 1: *Basic performance requirements*, and Part 2: *Helmets for pedal cyclists*) may be more appropriate for other than vehicle users where conditions of use dictate that a helmet is acceptable only if it is of low mass and compact.

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

PROTECTIVE HELMETS FOR VEHICLE USERS

1 SCOPE. This Standard specifies requirements for protective headgear for vehicle users, as designed to mitigate the adverse effect of a blow on the head. The Standard is written with particular reference to motor cyclists, but is equally applicable to users of other types of vehicle.

Specific marking requirements are also included.

NOTE: Recommendations for characteristics of materials used in the manufacture of protective helmets are provided in Appendix A.

2 REFERENCED DOCUMENTS. The documents below are referred to in this Standard.

AS

1609	Eye protectors for motor cyclists and racing car drivers
2512	Methods of testing protective helmets
	Method 1: Definitions and headforms (AS 2512.1)
	Method 2: General requirements for the conditioning and preparation of test specimens and laboratory conditions (AS 2512.2)
	Method 3.1: Determination of impact energy attenuation—Helmet drop test (AS 2512.3.1)
	Method 4: Determination of penetration resistance (AS 2512.4)
	Method 5: Determination of strength of retention system and its attachment points (AS 2512.5)
	Method 6: Measurement of peripheral vision clearance (AS 2512.6)

3 DEFINITIONS. For the purpose of this Standard, the definitions given in AS 2512.1 apply.

4 CONSTRUCTION.

4.1 General. The helmet shall consist of a shell with a hard smooth outer surface capable of resisting penetration, a means of absorbing impact energy, and a retention system.

None of the protective components of the helmet shall be inadvertently detachable.

Any devices attached to the helmet shall be such that they are unlikely to cause injury to the wearer in the event of an accident.

4.2 Retention. The retention system shall be constructed so that when properly fastened the helmet cannot be readily dislodged from its normal position on the wearer's head under impact conditions. A chin cup shall not be fitted to the chin strap.

4.3 Projections.

4.3.1 Rigid projections on internal surface of shell. Rigid projections on internal surfaces shall comply with the following:

- (a) *Above the test line*, the only rigid projections shall be those for the attachment of eye protection, communication, ventilation systems, and life support

equipment, and these shall have an overall height not greater than 2 mm, measured from the internal surface of the shell.

- (b) *Between the test line and the basic plane*, rigid projections shall be such that, when the helmet is tested in accordance with Clause 6.2 using a hemispherical anvil only for one impact onto the projection from outside the shell, the impact energy attenuation shall comply with the requirements of Clause 6.2, except as follows:

When the overall height of the projection, measured from the internal continuous shell surface, is not greater than the following, the projection shall be deemed to comply with Clause 4.3.1(b):

- (i) For chin strap attachment 5 mm.
(ii) For other purposes 2 mm.

NOTE: Continuous shell surface is to be taken to mean a reference surface that disregards local depressions and raised parts.

- (c) *Below the basic plane*, any rigid projection shall be of such location and size as will be unlikely to allow the projection to cause injury to the wearer.

NOTE: Energy-absorbing materials, chamfering of projection corners, padding, and a maximum projection height of 5 mm will reduce the likelihood of injury.

4.3.2 Rigid projections on external surface. Only rigid projections necessary for the retention system and the attachment of eye protection, communication and ventilation systems, and life support equipment, shall be permitted, and such projection shall have a height of not more than 5 mm.

4.3.3 Shell opening(s). The edge of shell neck and eye openings shall be —

- (a) finished with an attached edging that is neither hard nor brittle; or
(b) fully rounded.

NOTE: The above requirements are intended to reduce or eliminate injury from contact with the edges of openings.

4.4 Visors. Where a helmet is fitted or supplied with a visor, that visor shall comply with AS 1609.

5 MATERIALS. Except as specifically provided for herein, the characteristics of the materials used in the manufacture of helmets shall be established by the manufacturer as being suitable for the purpose, having regard to the provisions of Appendix A.

6 PERFORMANCE REQUIREMENTS.

6.1 General. The tests specified in Clauses 6.2 and 6.3 shall be applied at any points above the test line, other than specifically excluded within that Clause.

The sequence of tests shall be as follows:

- (a) Peripheral vision.
(b) Strength of retention system.

- (c) Impact energy attenuation.
- (d) Resistance to penetration.

NOTES:

1. This sequence ensures that tests which require the helmet to be intact are carried out before any cutting of the helmet, as such alteration may reduce the rigidity of the helmet.
2. To enable the tests to be correctly applied, it is necessary for the helmet manufacturer to specify the helmet positioning index (see Clause 10). It is a requirement of AS 2512.5 that the helmet positioning index be known and applied by the tester, and recorded on the test report.
3. It is expected that impact tests will be specified for regions below the basic plane and in the chin region at a future date.

Conditioning, including conditioning by solvent, and preparation of test specimens for testing shall be in accordance with AS 2512.2.

NOTE: Conditioning by solvent may be waived where it has been shown to the satisfaction of the certifying body that such conditioning is not relevant to the particular helmet model and shell material.

6.2 Impact energy attenuation. When determined in accordance with AS 2512.3.1, the headform acceleration shall not exceed the following:

- | | |
|-----------------------------------|--------|
| (a) Peak acceleration | 300 g. |
| (b) Cumulative duration of 3.0 ms | 200 g. |
| (c) Cumulative duration of 6.0 ms | 150 g. |

NOTE: The acceleration due to gravity (g) should be taken as $9.806\,65\text{ m/s}^2$. This gives values for (a), (b), and (c) of 2942 m/s^2 , 1961 m/s^2 , and 1470 m/s^2 respectively.

None of the protective components of the helmet shall become detached under test impact. Accessories shall not be fitted for this test.

The helmet shall be subjected to impact at four sites with two successive impacts at each site. The centres of each pair of impacts shall be not more than 6 mm apart.

Two pairs of impacts shall be by a flat anvil and two by a hemispherical anvil.

The heights of guided free fall onto hemispherical and flat anvils shall be 1385 ± 30 , -5 mm and 1830 ± 30 , -5 mm respectively.

6.3 Resistance to penetration. When the helmet is tested in accordance with AS 2512.4, there shall be no contact between the striker and the surface of the test headform.

The penetration test site(s) shall be at a point above the test line but not on a fastener or other rigid projection. Sites shall be at least 76 mm apart, and at least 76 mm from the centres of any impacts applied during the impact energy attenuation test. At least two penetration sites shall be tested.

The height of the guided free fall shall be $3000 \pm 15\text{ mm}$.

6.4 Strength of retention system. When the helmet is tested in accordance with AS 2512.5, with a preliminary test loading of $225 \pm 5\text{ N}$ applied for 30 s, and an additional loading of $1110 \pm 25\text{ N}$ applied for 120 s, the retention system or its attachments shall not separate, and the elongation between pre-loading and test loading shall not exceed 25 mm.

Where the retention system consists of components which can be independently fastened without securing the complete assembly, each such component shall independently comply with the requirements of this Clause.

NOTE: Components provided only to restrain a free-end of the restraint system are not to be considered as load-bearing.

6.5 Peripheral vision. When determined in accordance with AS 2512.6, the peripheral vision clearance shall be not less than 105 degrees on each side of the mid-sagittal plane. The brow opening of the helmet shall be at least 25 mm above all points in the basic plane that are within the specified angle of peripheral vision.

7 TYPE TESTING. At least four helmets of the same size shall be submitted for test. The helmets shall be in the condition in which they are offered for sale and shall be accompanied by all attachments, including eye protection, communication, and life support equipment normally sold with the helmet.

NOTE: The certifying body may waive tests on some helmets within a range of helmets on the basis of engineering evaluation.

8 MARKING. Each helmet shall be permanently and legibly marked so that the marking can be easily read without the removal of padding, or other permanent part, with the following:

- (a) Name of manufacturer.
- (b) Model designation.
- (c) Size.
- (d) Month and year of manufacture (may be spelled out, e.g. 'July 1987', or in figures, e.g. '7/87').
- (e) The words 'Vehicle User's Helmet'.
- (f) Instructions to user:
 - Shell and liner constructed of (identify type(s) of material).
 - Helmet can be seriously damaged by substances such as petrol, paint, adhesives, or cleaning agents.
 - Make no modifications.
 - Fasten helmet securely.
 - If helmet experiences a severe blow return it to the manufacturer for inspection or destroy and replace it.
- (g) The certification mark (where required by Statutory Authorities).

NOTE: Manufacturers who place the number of this Australian Standard on products, or on packaging or literature related thereto, should ensure that the products are manufactured to comply with the Standard.

Attention is particularly drawn to the scheme for independent assurance provided by the StandardsMark which is a registered certification trademark owned by the Standards Association of Australia and which is available for use with suitable Australian Standards.

The presence of the StandardsMark on or in relation to a product is an assurance that the goods have been produced under a system of supervision, control and testing applied during manufacture and including periodical inspections at the manufacturer's works in accordance with the certification mark scheme of the SAA.

The StandardsMark can be used only by manufacturers licensed under the certification mark scheme operated by SAA, and only when accompanied by the number of the relevant Australian Standard. It will usually be a requirement that the words 'Manufactured to Australian Standard' accompany the number of the Standard and enclose the Mark as shown below; however, this is a matter for negotiation with the Association.

Further particulars of the terms of licence and suitability of this Standard for certification purposes may be obtained from the Quality Assurance and Certification Department, Standards Association of Australia, 1 The Crescent, Homebush NSW 2140.



9 LABELLING. In addition to the marking requirements of Clause 8, each helmet shall be accompanied by an informative brochure or label which shall include the following information:

- (a) No helmet can protect the wearer against all possible impacts.
- (b) For maximum protection the helmet must fit firmly on the head, and all retention straps must be securely fastened. With the chin-strap comfortably but firmly adjusted, it should not be possible in most cases for the helmet to be removed from the head when pulled at the rear in an upward direction.
- (c) The helmet is designed to be retained by a strap under the chin.
- (d) The helmet is suitable*/unsuitable for use with goggles.
- (e) No attachments should be made to the helmet except those recommended by the helmet manufacturer. Do not drill or cut the shell.

- (f) The helmet is designed to absorb shock by partial destruction of the shell and liner. This damage may not be visible. Therefore if subjected to a severe blow, the helmet should be replaced even if it is apparently undamaged.
- (g) The liner is essential to the intended performance of the helmet.
- (h) The helmet may be damaged and rendered ineffective by petroleum and petroleum products, cleaning agents, paints, adhesives, etc, without the damage being visible to the user. The following materials only should be applied to the helmet for cleaning purposes: (List materials).

10 INFORMATION TO BE SUPPLIED BY MANUFACTURER. The helmet positioning index shall be given by the manufacturer to any person requesting that information, for a helmet identified by at least the detail of manufacturer, model designation, and size.

NOTE: This information is necessary for test purposes, see Clause 6.1.

* Delete word not applicable.

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APPENDIX A
CHARACTERISTICS OF MATERIALS USED IN THE
MANUFACTURE OF PROTECTIVE HELMETS

(This Appendix does not form an integral part of this Standard.)

The following material characteristics are recommended:

- (a) Known not to undergo appreciable alteration under the influence of ageing, or the circumstances of use to which the helmet is normally subjected, such as exposure to sunlight, extremes of temperature, and rain. Ultraviolet inhibitors should be used where necessary.
- (b) For parts of the helmet coming into contact with the skin or hair, known not to undergo appreciable alteration arising from contact with perspiration or skin or hair toiletries.
- (c) Known not to cause skin irritations or disorders.
- (d) For metal parts used in the construction of the helmet, corrosion-resistant or having corrosion-resistant finish.
- (e) For the shell, known not to support flame propagation.